Natural Heritage &
Endangered Species
Program

MA Division of Fisheries & Wildlife
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Westborough, MA 01581
(508) 389-6360
www.nhesp.org

Small Research Contracts Program

2008 Request for Proposals

The Natural Heritage & Endangered Species Program (NHESP) is soliciting proposals for field studies to be conducted in 2008. The objective of the Small Research Contracts Program is to support field inventories and scientific research which will contribute to our ability to protect rare and endangered wildlife and plants and their habitats in Massachusetts.

Proposals that address stated priorities of the Natural Heritage & Endangered Species Program are most likely to receive funding, although all proposals will be given serious consideration for support. Projects that contribute to the conservation and management of the rarest and most threatened species and natural communities in the state will be given the highest priority for funding.

DEADLINE FOR RECEIVING APPLICATIONS: **February 22, 2008**

AWARDS TO BE ANNOUNCED BY: **March 28, 2008**

Funds:

Voluntary contributions to the Natural Heritage & Endangered Species Fund on state income tax forms comprise a significant portion of the Program's operating budget. We will also be able to provide targeted funding from several different sources (e.g. Army Corps of Engineers). Please see the list of priority topics beginning on page three.

Application Guidelines:

1. Applicants must submit a brief proposal in the following format:

   Title page: project title and brief abstract; name, address, phone number, position and affiliation of investigator(s); proposed starting and completion dates; total amount requested from the NHESP.

   Narrative of 1-6 pages including: a) objectives, b) brief review of what is already known, c) methods, d) value of project to NHESP, e) detailed budget, f) project timetable including when and in what form NHESP will receive research results, and g) literature cited.

   Brief statement of qualifications of investigator(s) and resume. A letter of recommendation is required for undergraduate students.

   Only applicants following stated guidelines will be considered.

2. Funds may be granted for travel ($.40/mi.), subsistence, equipment and supplies. Further compensation will be considered, depending on the scope and importance of the proposed research and the qualifications of the investigator(s).

3. Single-year proposals will be considered for complete or partial funding. Applicants should indicate if other sources of support are being sought. Demonstration of matching funds will be viewed favorably. Institutional overhead will not be funded. A portion of funds awarded will be withheld pending submission and acceptance of the final products to the NHESP.

4. Proposals will be evaluated by NHESP staff in conjunction with the Division of Fisheries & Wildlife's Natural Heritage & Endangered Species Advisory Committee. Final selection will be based on:
    a) contribution to the goals and objectives of the NHESP,
    b) conservation and/or management applications,
    c) scientific merit,
    d) feasibility,
    e) budget (i.e., economic efficiency), and
    f) qualifications of investigator(s).

Proposed investigations may include extensive field inventories and/or intensive research into particular species or sites. Lists of rare plant and animal species and rare natural community types are available from the NHESP or directly from our web site (www.nhesp.org). Interested researchers are encouraged to consult with the Program to determine if their research interests meet our objectives before submitting a proposal. Successful applicants will be expected to submit completed **field observation forms** (to be supplied by the Program and also available at www.nhesp.org), including a topographic map, in addition to their **final report**. Final reports may be submitted electronically.

For answers to administrative and financial questions, please contact Karen Dolan at (508) 389-6349 or via e-mail at karen.dolan@state.ma.us. For answers to taxon-specific questions, please refer to the NHESP Staff Directory at http://www.nhesp.org.

Proposals should be either sent electronically to natural.heritage@state.ma.us, or faxed to (508) 389-7891, or mailed to:

Small Research Contracts
Natural Heritage & Endangered Species Program
MA Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife

2008 SMALL RESEARCH CONTRACTS PROGRAM

Priority Topics

LOCALITY-SPECIFIC TOPICS

Housatonic Watershed, Southern Berkshire County

Taxon	Proposal	staff contact
Marsh Birds	Please see the Commonwealth's job postings for descriptions of seasonal Marsh Bird Technician contract positions.	Chris Buelow
Lepidoptera	Targeted surveys for 3 species, Mustard White (in 2008) and Dion Skipper (in 2008) and Ostrich Fern Borer moth (in 2009) using host plant location data from 2008 plant and community surveys.	Mike Nelson
Odonates	The mainstem of the Housatonic River has been undersurveyed for rare Odonates compared to other major rivers in Massachusetts. Collect and identify exuviae every 2 km. The river is approximately 26 km (16 mi) miles from Pittsfield to the dam at Wood Pond in Lee, and 69 km (43 gis miles) from that dam to the Connecticut border.	Lynn Harper
Bog Turtles	Assess the effectiveness of invasive and woody species control at Bog Turtle (*Glyptemys muhlenbergii*) sites in Berkshire County. Vegetation and turtle population monitoring to determine their response to habitat management. Work will be done in 2008-2009. In addition, work collaboratively with NHESP Turtle Conservation Biologist to perform targeted de novo surveys for the Bog Turtle.	Lori Erb
Wood Turtles	Work collaboratively with NHESP Turtle Conservation Biologist to 1) perform targeted biological surveys for the Wood Turtle (*Glyptemys insculpta*) along the main stem and some tributaries of the Housatonic River and 2) assess Wood Turtle habitat along the Housatonic and make recommendations for habitat improvement. Primarily a project for 2008, with some follow-up in 2009 as necessary.	Lori Erb
Vernal Pools	There are currently 70 Certified Vernal Pools (CVPs) and 786 Potential vernal pools (PVPs) located in the Housatonic River watershed. Targeted, comprehensive surveys on PVPs will increase our knowledge about the abundance and distribution of vernal pool habitat in the watershed. Furthermore, biological surveys at PVPs would likely lead to certification of more vernal pools and possible identification of state-listed species habitats. This could increase vernal pool protection and improve conservation strategies for amphibians and other vernal pool wildlife in the Housatonic watershed.	Lisa Plagge
Jefferson Salamanders	Conduct surveys to (1) identify new locations of *Ambystoma jeffersonianum* in relatively intact landscapes with minimal road traffic; (2) update older records; and (3) locate breeding pools at locations where *A. jeffersonianum* is known to exist, but their breeding sites have not yet been identified (i.e., only terrestrial observations of salamanders have been documented). This survey work would increase our understanding of the distribution of *A. jeffersonianum*, which would better enable development of conservation strategies for the species in the Housatonic River watershed	Lisa Plagge

Taxon	Proposal	staff contact
Four-toed Salamanders	Conduct surveys to identify new locations of *Hemidactylium scutatum* and evaluate its status in the Housatonic River watershed. Intensive state-wide surveys, have documented that *H. scutatum* is well distributed in the eastern and central regions of the state, but, there are relatively few records in the western region. Additionally, inventory work in the watershed could help us to learn why there might appear to be a disparate distribution of the species among different regions of the state. For instance, comprehensive surveys might help to determine whether differences in search effort or subtle differences in habitat use or seasonality among regions, can explain our current understanding of the statewide distribution of *H. scutatum.* Such information will be critical to the development of regional and statewide conservation objectives and strategies for the species.	Lisa Plagge
Freshwater Mussels	Update the status and distribution of *Alasmidonta undulata* and *Strophitus undulatus* in the Housatonic River and some tributaries. Comprehensive, qualitative mussel surveys and habitat assessments should be conducted at selected sites to assess mussel distribution, abundance, age class structure and recruitment, habitat, and development threats. Sites survey should be prioritized based on their suitability to support populations of state-listed mussels and conservation recommendations should be made for each site. The river is approximately 26 km (16 miles) from Pittsfield to the dam at Wood Pond in Lee, and 69 km (43 GIS-miles) from that dam to the Connecticut border.	Marea Gabriel
Freshwater Mussels	Assess the recruitment success of *Alasmidonta undulata* and *Strophitus undulatus* at selected sites in the mainstem Housatonic River. Conduct quantitative mussel surveys and subsurface explorations to measure population density and characterize age class structure of both species; specific emphasis will focus on locating juveniles and young mussels.	Marea Gabriel
Plants	Survey rare plant occurrences of aquatic and alluvial communities directly associated with the Housatonic River. In addition, evaluate the mapped species habitat areas associated with these occurrences and search them for additional rare plants. Undertake inventories aimed at discovering new rare plant stations, using aerial photography for guidance to sites. Assess and prioritize threats to rare plant species and their habitats and identify management needs. NHESP will coordinate and direct this fieldwork, which will be performed in part by the staff botanist but largely by contracted field botanists.	Jen Garrett, Melissa Cullina
Natural Communities	Check and assess natural vegetation along Housatonic riparian areas from GE plant south. Determine natural communities where appropriate and evaluate needs for ecological restoration. Plots will be sampled in good community occurrences and in all of the rarest types. (This is the position posted on the state jobs website as a seasonal position.) The river is approximately 26 km (16 miles) from Pittsfield to the dam at Wood Pond in Lee, and 69 km (43 GIS- miles) from that dam to the Connecticut border.	Pat Swain

Charles River Marshes, Army Corps of Engineers, mostly in Medfield and Millis

NHESP staff contact: Pat Swain

Natural Heritage & Endangered Species Program anticipates receiving funding to conduct planning-level surveys for rare species in the Charles River Natural Valley Storage Area, "Area G" Marshlands. Surveys would include: birds, particularly marsh birds; reptiles, amphibians, and vernal pools; moths and butterflies; and dragonflies and damselflies in seasonally appropriate inventories. (Inventories for rare plants, natural communities and freshwater mussels were recently completed.)

The Charles River Natural Valley Storage Area, Area G Marshlands are located primarily in the towns of Medfield and Millis, with small portions in Norfolk and Walpole, with a total of 1149 acres owned in fee, which would be the lands targeted for inventory. An additional 1507 acres with flowage easements would not be expressly targeted for inventory.

Contractors would do preparation, inventory work, an interim report (September) and a final report (December 31, 2008) in cooperation with, and oversight by, the project manager and relevant biologists at NHESP. Contractors would be supplied with information on currently known rare species and natural communities on the property and in the area.

We anticipate approximately $4,000 to $6,000 being available for each category (each header) below.

We are interested in contractors with experience in surveys for:

Reptiles, amphibians and vernal pools: Inventory for state listed turtles and salamanders, and other rare species, including extent of habitat and population size as much as can be determined in the time allowed. There are two potential vernal pools (PVPs) identified and no certified vernal pools currently on the property. The herpetology contractor would be expected to examine the PVPs (and other likely places) and collect information about whether each pool is certifiable. Certifiable pools would have packages prepared as if for certification, but delivered as part of the final report.

Birds: focus on marsh birds using playback (NHESP has a protocol that is expected to be used) and use of the property by migrants. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Moths and butterflies: Contractors for Lepidoptera would plan and undertake sampling and identification, and submit interim and final reports on all species found. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Dragonflies and damselflies: Contractors for Odonata would plan and undertake sampling and identification, and submit interim and final reports. Sampling of exuviae and larvae would be expected. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Tully Lake Property, Army Corps of Engineers , Royalston

NHESP staff contact: Pat Swain

NHESP is anticipating a contract with the Army Corps of Engineers to provide their New England District (NED) with information and planning-level surveys regarding the biological resources of the Tully Lake property in Royalston. Specifically, surveys would be undertaken for rare and protected species and exemplary and uncommon natural communities. Surveys will include vascular plants (including aquatic plants); birds, particularly marsh birds; reptiles, amphibians, and vernal pools; freshwater mussels; moths and butterflies; and dragonflies and damselflies in seasonally appropriate inventories

The Tully Lake property is primarily located in the town of Royalston, MA (1257 GIS-acres), with small acreages in Orange (30 GIS-acres) and Athol (91 GIS-acres), for a total of 1378 GIS-acres owned in fee, which would be the

lands targeted for inventory. Developed areas (for example, campgrounds and picnic areas) would not be focused on for inventory.

Contractors would do preparation, inventory work, an interim report (September) and a final report (December 31, 2008) in cooperation with, and oversight by, the project manager and relevant biologists at NHESP. Contractors would be supplied with information on currently known rare species and natural communities on the property and in the area.

We anticipate approximately $2,000 to $5,000 being available for each category (each header) below.

We are interested in contractors with experience in surveys for:

A **project manager** may be contracted to oversee the project including writing summaries for the interim (September 2008) and final (January 31, 2009) reports. Experience in project oversight / supervision and rare species surveys would be a major plus.

Reptiles, amphibians and vernal pools: Inventory for state-listed turtles and salamanders, and other rare species, including extent of habitat and population size as much as can be determined in the time allowed. There are nine potential vernal pools identified and no certified vernal pools on the property. The herpetology contractor would be expected to examine the PVPs (and other likely places) and collect information about whether each pool is certifiable. Certifiable pools would have packages prepared as if for certification, but delivered as part of the final report.

Birds: focus on marsh birds using playback (NHESP has a protocol that is expected to be used) and use of the property by migrants. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Moths and butterflies: Contractors for Lepidoptera would plan and undertake sampling and identification, and submit interim and final reports on all species found. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Dragonflies and damselflies: Contractors for Odonata would plan and undertake sampling and identification, and submit interim and final reports. Sampling of exuviae and larvae would be expected. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Freshwater mussels: Rivers and ponds surveyed for state-listed freshwater mussels, with population and habitat assessments. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Vascular plants: All habitats, including the lakes on the property should be inventoried for rare species. If rare species are found, the habitat would be mapped, and rare species observation forms submitted to NHESP.

Natural Communities: NHESP priority natural community types would be the focus of inventory. Any priority or exemplary examples of more common natural communities would be sampled with plots, using NHESP forms. Locations, including boundaries, of the priority types, and preliminary quality and condition ranks would be expected in the final report.

Recently Protected Lands

As funding permits, conduct natural community and rare species inventories of lands protected by the Division of Fisheries & Wildlife, such as: Black Brook Wildlife Management Area (WMA), Middleborough; Surrenden Farms WMA, Groton; Plymouth Town Forest, Plymouth; Bolton Flats WMA, Lancaster/Harvard/Bolton; Freetown Swamp WMA, Freetown; Tekoa Mountain WMA, Russell/Montgomery; and Old Sturbridge Village Wildlife Conservation Easement, Sturbridge.

Projects should include one or more of the following services and products:

- Identification, description, sampling and mapping of natural communities within identified study areas. Procedures will follow NHESP natural community sampling format. Sampling plots are required for rare and unusual communities; thorough written descriptions are required for common, widespread community types. Successional stages, evidence of land use history, and natural disturbance history also must be recorded.

- Locating, identifying and mapping rare plant populations as listed under the Massachusetts Endangered Species Act (MESA) and on the unofficial state "watch list" maintained by NHESP.
- Identifying and mapping invasive exotic plant species.
- Surveying reptile, amphibian and/or bird communities with special reference to the location and habitat requirements of species protected by MESA or otherwise identified as species of conservation concern (Partners-in-Flight for birds etc.) and surveying and documenting vernal pools.
- Conducting surveys of state-listed invertebrate species.
- Sampling bird, Lepidoptera, and plant populations to evaluate habitat management and restoration treatments.
- Performing ecological restoration and natural resource management planning for specific areas.
- Performing ecological fire management planning for selected sites including prescriptions for specific prescribed burns.
- Sampling wetlands and performing vegetation history reconstructions using palynological methods or other sediment analysis techniques.
- Performing land use history research using literature records, aerial photographs, oral histories, interviews and on-site analyses.
- Planning and conducting the monitoring of biological responses to restoration and management actions.
- Conducting evaluations of the impacts of hydrological alterations on biological resources.

TAXON AND NATURAL COMMUNITY-SPECIFIC TOPICS

Reptiles and Amphibians

- Evaluate turtle and amphibian health and disease prevalence. Of particular interest are tests for the fungus, *Batrachochytrium dendrobatidis*, and the virus, *Ranavirus*. Possibility of two-year funding.
- Work collaboratively with NHESP Turtle Conservation Biologist to assess the effectiveness of previously-installed turtle culverts. Primarily a project for 2008, with the possibility of funding in 2009 as necessary.
- Monitor targeted Red-bellied Cooter (*Pseudemys rubriventris*) populations to evaluate population condition (reproductive output and overall health) and success of headstarted juveniles. This is a potential Master's thesis project, with the possibility of two-year funding.
- Surveys for undocumented populations of Eastern Wormsnake (*Carphophis amoenus*). Primarily a project for 2008, with the possibility of funding in 2009 as necessary.
- Work collaboratively with NHESP to perform surveys for three state-listed snake species, the Eastern Ratsnake (*Elaphe obsoleta*), Timber Rattlesnake (*Crotalus horridus*), and Copperhead (*Akistrodon contortrix*). Primarily a project for 2008, with the possibility of funding in 2009 as necessary.

Moths and Butterflies

- Autecological study of the Straight Lined Mallow Moth (*Bagisara rectifascia*) in Massachusetts in order to document precise habitat and host plant requirements.

Dragonflies and Damselflies

- Survey previously unsurveyed (or undersurveyed) rivers for presence of state-listed dragonflies. Surveyors should rely primarily on exuvial and nymphal searches, with secondary emphasis on searches for adults. Rivers in need of survey include the Quinebaug, French, Sudbury/Assabet/Concord, Ipswich, Charles, Neponset, and Taunton, and the Nashua River in Leominster and Lancaster.
- Survey appropriate wetlands in Berkshire, Franklin, Hampshire, Hampden, and southern Worcester counties for the New England Bluet (*Enallagma laterale*) during its June flight period.

Freshwater Mussels

Work collaboratively with the NHESP Aquatic Ecologist to determine survey sites and appropriate survey methodology. SCUBA may be necessary in depths over four feet.

1. Update the status and distribution of the state Endangered Brook Floater Mussel (*Alasmidonta varicosa)* in: (1) the Ware River in Palmer, Ware, Hardwick/New Braintree, and Barre; (2) the Nissitissit River in Pepperell; and (3) Bachelor Brook in South Hadley and Granby.
   - Comprehensive, qualitative mussel surveys and habitat assessments will be conducted within the Ware River and some tributaries to assess mussel distribution, abundance, age class structure, habitat, and development threats.
   - Quantitative mussel surveys and subsurface explorations may be conducted at selected sites to estimate subpopulation density and characterize age class structure; specific emphasis will focus on locating juveniles and young mussels.
   - Sites surveyed will be prioritized based on their suitability to support populations of the Brook floater and conservation recommendations will be made for each site.

2. Update historic records of the state Endangered Brook Floater Mussel (*Alasmidonta varicosa*). Ten of the 13 historic brook floater records contain locational information. Determine which of these sites may contain suitable habitat for the brook floater; conduct qualitative mussel surveys and habitat assessments at selected sites to determine presence/absence of the Brook Floater, assess mussel distribution, abundance, age class structure, habitat, and development threats.

3. Characterize mussel populations located in the vicinity of docks versus those at sites without docks in lake(s) in southeastern Massachusetts. Conduct qualitative mussel surveys in suitable mussel habitat at docks and at nearby non-dock sites; compare and assess mussel distribution, abundance, age class structure, habitat characteristics, and threats.

Freshwater Snails

- Status assessment for any of the six species of state-listed snails (see list at NHESP web site, www.nhesp.org), to update occurrence data, survey for new sites, and assess statewide status. If a state-listing status change is appropriate, prepare such a proposal.

Other Invertebrate Animals

- New England Medicinal Leech (*Macrobdella sestertia*) has not been recorded at known localities for many years, and these sites need to be re-surveyed. Additional, undocumented sites should also be sought.
- Many potential sites for Northern Spring Amphipod (*Gammarus pseudolimnaeus*) are in need of survey effort.
- Piedmont Groundwater Amphipod (*Stygobromus tenuis tenuis*) and Taconic Cave Amphipod (*Stygobromus borealis*) have not been recorded at known localities for many years, and many caves have never been surveyed. For known occurrences, investigators need to coordinate landowner contact with NHESP.

Plants

- *Acer nigrum* (Black Maple) is a species of Special Concern in Massachusetts. The taxon is often difficult to separate from pubescent forms of the common *A. saccharum,* and a systematic examination of voucher specimens in Massachusetts herbaria revealed several mis-determined collections. Approximately 10 stations of *A. nigrum* in Massachusetts are unvouchered; in order for NHESP to continue to track these stations as "element occurrence" records, searches for *A. nigrum* must be made, vouchers must be collected and deposited at a public herbarium, and identifications must be confirmed. We are seeking a qualified individual to perform these searches, make the collections, and to collaborate with NHESP botanists on species determinations. Directions and maps will be provided by NHESP.
- *Eleocharis diandra* (Wright's Spike-sedge) is a globally rare (G1G2), Endangered Species recently added to the state list. Found along silty alluvial shores in Massachusetts, this annual species is poorly understood relative to other globally rare taxa in the state. *De novo* searches are needed, particularly along the Connecticut River, in appropriate habitat near existing occurrences in order to better understand where and how this annual species can be protected in the Commonwealth. We are seeking a qualified botanist to 1) visit and survey the existing stations, 2) conduct *de novo* searches, and 3) document any new stations and their supporting habitats. Specific EO data and other likely habitat areas will be provided by NHESP.

- *Pyrola asarifolia* ssp. *asarifolia* (Pink Pyrola) is an Endangered Species of calcareous seepage swamps in Massachusetts. It is documented at only two locations, each in 1983. We are seeking a qualified botanist to search for the plant at the two 1983 stations and to search additional appropriate habitat for this and other listed species in central Berkshire County. Specific occurrence data and other likely habitat areas will be provided by NHESP.
- *Carex deflexa*, formerly a state-historic species, was rediscovered in Massachusetts during a 2006 search by NHESP botanists. More common to our north, it was added to the unofficial NHESP plant Watch List in 2007 because it is unclear whether this inconspicuous sedge is rare or merely overlooked in Massachusetts. NHESP seeks to further study its status and distribution in Massachusetts before considering a possible recommendation that it be added to the state list. NHESP is seeking a qualified botanist to conducted searches for this taxon at the current and several historical locations, and in other appropriate habitat areas. Specific occurrence data and other likely habitat areas will be provided by NHESP.
- *Cystopteris laurentiana* (Laurentian Bladder Fern) is a globally rare (G3) taxon which was confirmed as present in Massachusetts during 2006. A fertile hybrid of *C. bulbifera* and *C. fragilis*, this rare, Watch-listed fern grows on shaded calcareous cliffs. NHESP seeks to further study its status and distribution in Massachusetts before considering a possible recommendation that it be added to the MESA list. We are seeking a qualified botanist to search known areas and new areas in order to determine 1) whether this taxon is able to exist in the absence of one or both parent taxa and 2) how prevalent it is in Massachusetts. Specific occurrence data and other likely habitat areas will be provided by NHESP.

Natural Communities

- Inventories for different Natural Community types with plot data collected for revising and improving the draft Classification of Natural Communities of Massachusetts and locating exemplary occurrences. Proposals for any type of natural community will be considered although particular community types of interest are:

Spruce-Fir Boreal Swamps and forested acidic peatlands

Identify and sample in exemplary Hemlock Hardwood Swamps for comparison of the understory with understory of Spruce-Fir Boreal Swamps;

Identify and sample in Spruce dominated peatlands for comparison with Spruce Fir Boreal Swamps.

Chestnut Oak forests, on ridgetops and off;

Hickory-Hop Hornbeam forest/woodlands- including land use history;

Forested talus slopes – in a variety of sites for comparisons;

Hemlock forests not in ravines;

Wet meadows; and deep and shallow emergent marshes.

Coastal Plain Pondshores, sampling and evaluation, with the focus on Coastal Plain Pondshores that were not reviewed in NHESP's 2002 report on Coastal Plain Pondshores, and are not shown in the MassGIS NHESP Natural Community datalayer. Many of the pondshores to be sampled and evaluated are on Cape Cod, from Chatham into the Outer Cape.

- The Department of Conservation and Recreation (DCR) is contracting with NHESP to coordinate a series of rare plant and natural community inventories on many small sites (2-80 acres), plus surrounding lands of rare species or community interest, on DCR lands across the state. Comprehensive species lists for sites would be expected. Interested botanists and ecologists should contact Pat Swain (pat.swain@state.ma.us). Anyone interested should be on the Commonwealth's Master Service Agreement (H251A) that covers biological inventories.

See Housatonic and ACOE Tully Lake and Charles River Marshes inventories for other inventory needs for Natural Communities.